MAR 28 1922

PUBLIC WORKS

CITY COUNTY STATE

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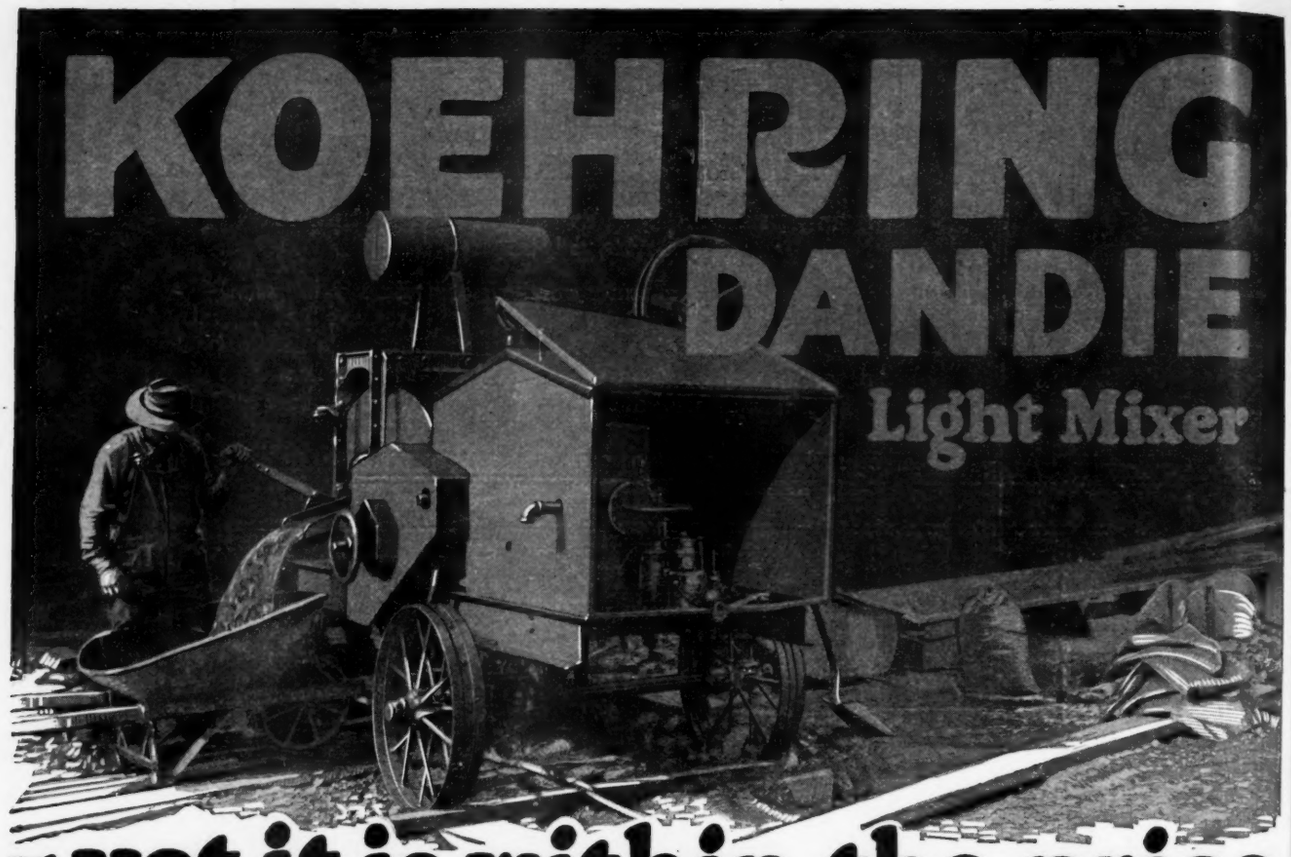

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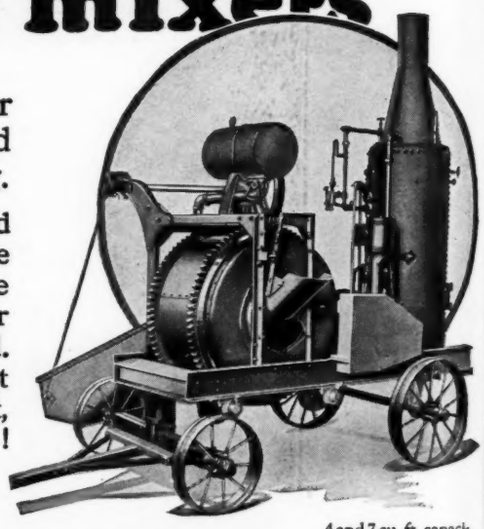

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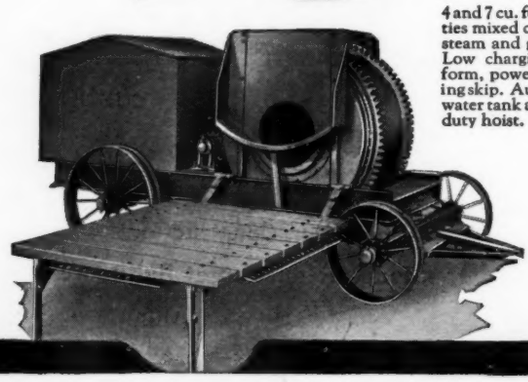

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CITY COUNTY STATE

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Vol. 52 March 25, 1922 NO. 12

Gilboa Dam Construction

Exploration borings, pressure tests, river diversion, foundations, excavation and installation of contractor's plant

The Gilboa Dam, now under construction for a contract price of $6,819,910 by the Hugh Nawn Contracting Co. for the Board of Water Supply, New York City, J. Waldo Smith, Chief Engineer, is being built across the Schoharie creek to impound its waters in the Schoharie reservoir with a capacity of about 22,000,000,000 gallons, as described in PUBLIC WORKS, July 2, 1921.

The Dam will have a concrete spillway section 1,300 feet long, 160 feet high, 15 feet wide at the top and 165 feet wide at the bottom, and an earth embankment 1,000 feet long and 445 feet wide at the base. The principal quantities involved are 90,000 cubic yards of rock excavation, 296,000 yards of earth excavation, 436,000 yards of masonry and 617,000 yards of earth embankment.

During the year 1921, explorations were made of the pre-glacial gorge upstream from the dam by seven holes, aggregating 814 feet in length, and with a maximum depth of 197.5 feet which determined the depth of the bottom of the gorge and that the material encountered is generally impervious, consisting of fine red sand and clay with beds of red and blue clay and occasional pockets of gravel.

A series of pressure tests were completed that were intended to locate rock seams, indicate their connection with each other, and determine the approximate flow through them of water under a pressure equal to the maximum that will be developed after the construction of the dam. These tests show that in general there is considerable leakage in the upper part of the test holes made to explore the subterranean strata, and that the horizontal and vertical seams through which the leakage occurs decrease as the depth increases. No well-defined horizontal leakage planes extending over the entire area were observed, although seams were found in the shale and, better defined, in the sandstone. The results of the tests are shown on a special model which gives the location of seams and the amount of leakage and the connections between them and the geological formation. A study of the results of these tests determined the tentative location and depth of the cutoff trench and of the grout holes, subsequently drilled.

The dam site was protected by up stream and down stream cofferdams, through which two riveted steel pipes 10 feet in diameter carried the waters of the Schoharie creek. The waters of a small tributary, the Steen Kill, were by-passed by means of an artificial canal 10 feet wide at the bottom with side slopes of 1 on 2, a length of 300 feet, and a grade of 20 per cent., which was excavated with a steam shovel and drag scraper and surfaced by a grouted pavement 18 inches thick. Seepage was prevented by four cutoff walls at both ends and at two intermediate points. The 1:3 grout was mixed in a one-bag batch concrete machine, dumping into a mortar box, from which it was dipped by pails and poured into place on the paving, with which it kept close progress.

EARTH EXCAVATION

The earth in the foundation pit for the main dam was excavated by a steam shovel that delivered to 4-yard cars drawn by a dinky engine on a narrow-gage switchback track to the top of the pit and thence to a place where it was deposited in a blanket fill or to a spoil bank. The work was commenced with one shovel, a second shovel was installed April 18, 1921, and both were put on double shifts July 25. A small amount of material was also excavated on the east side of the Schoharie creek and removed by wagons. During the season of 1921, a total amount of 96,000 yards of dirt was excavated from the dam and the spillway channels.

ROCK EXCAVATION

Below the downstream toe of the dam, a sump was made, from which rock excavation was started upstream in a line transverse to the axis of the dam with a trench 10 feet wide, blasted with shallow holes and light charges of powder. The drilling was done by two tripod and two jackhammer drills, and after the completion of the trench, the excavation was carried on from it towards both ends of the dam, the sides of the trench forming faces of the excavation. The rock was blasted in two or three lifts according to the location of the seams, and was removed to an average depth of 6 feet before channeling for the cutoff trench was commenced. Con-

siderable decomposed shale rock was encountered, but became more compact as the excavation was carried into the hill. The muck was at first handled by one steam shovel, four steel derricks and one stiff-leg wooden derrick. The large sound pieces were reserved for cyclopean masonry, smaller pieces were sent to the stone crusher to make concrete aggregate, and waste material was hauled by wagons to a spoil bank.

After the installation of a 10-ton, 1900-foot span cableway in the axis of the dam, the steam shovel was removed and the muck was handled to the cableway by the stiff-leg derrick. The cableway delivered the rock to a hopper that loaded a 4-yard car running on a timber trestle 50 feet long to the rock crushing plant, after which the empty car was hauled back up the incline by a hoisting engine. Rock unsuitable for aggregate was dumped from the trestle into another 4-yard car operated by a hoisting engine that hauled it to the spoil bank. In the spillway channel the excavated rock was handled by a steel derrick and by a stiff-leg wooden derrick.

CUT-OFF TRENCH

So far as completed, the cut-off trench has a top width of 20 feet and a maximum depth of 20 feet and bottom width of 15½ feet with an approximately level bottom surface, rising in steps on the sides of the valley. The sides of the cut-off trench are cut with channeling machines making slots from 8 to 12 feet long and from 4 to 6½ feet in depth, and also by means of drill holes close together made by machines mounted on a quarrybar and subsequently broached by a special non-rotating bit. No blasting is allowed until both sides of the trench have been freed by channel cuts. The channeling has been carried on in one, two and three shifts daily, and was suspended for the season on December 20th.

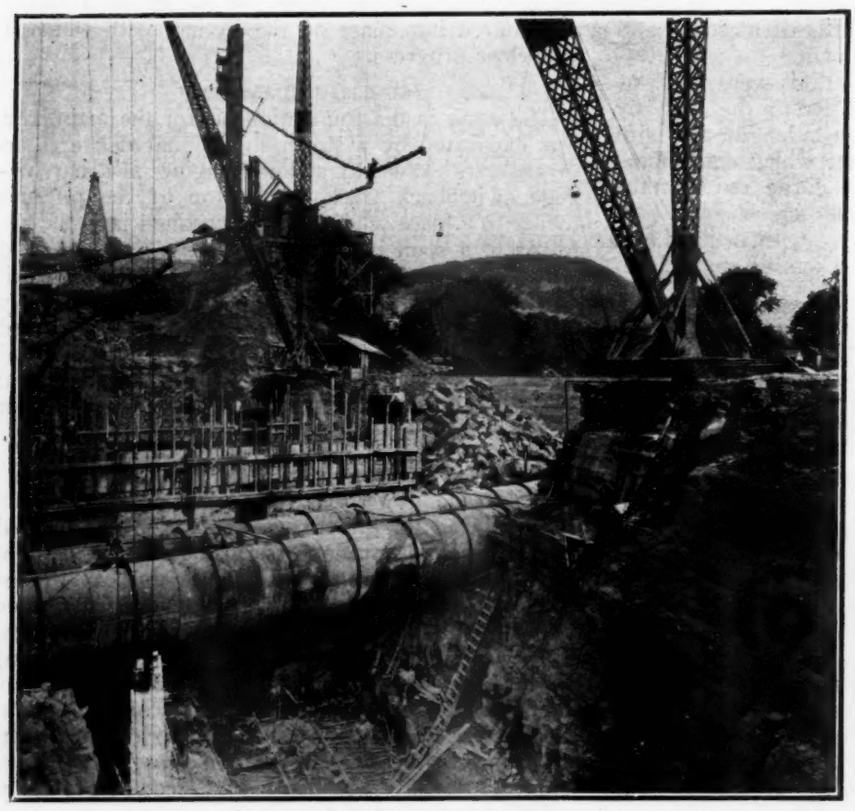
Difficulty was encountered on account of vertical seams and a satisfactory bit was not secured until one having a Z-shape cross section was built up of several pieces of black diamond steel and can be used for periods varying from 10 minutes to 2 hours without resharpening.

Diamond drill holes 2 1/16 inches in diameter were drilled 12½ feet apart on a line 5 feet from the dam line and at an angle 22½ degrees with the vertical. They were carried down to depths of 40 to 50 feet at the center of the gorge and to a less distance on the sides and encountered an artesian flow of subterranean water amounting to 100 gallons per minute. The holes were cleaned with water at 125 pounds pressure from a small perforated pipe lowered to the bottom of the holes. It is expected that grout pumped into these holes under pressure will fill the seams and prevent leakage under the dam.

REMOVAL OF COFFERDAM

Although the crest of the upstream cofferdam was higher than that of the downstream cofferdam, it was, during the year, overflowed six times by floods lasting from 6 to 47 hours and submerging it to a depth of from 1.9 to 3 feet. After the interior of the cofferdam was flooded, it was unwatered by a 6-inch electrical centrifugal pump and a 6-inch duplex pump, after which the interior was easily kept dry by the duplex pump working only a portion of the time.

When there was no longer necessity for the cofferdam, 23 holes were drilled in a 46-foot long section of the lower cofferdam, loaded with 250 pounds of 8 per cent. dynamite and fired, removing that portion of the dam without much disturbance of the adjacent sections. About a week later a corresponding section of the upper cofferdam was blown out with 400 pounds of powder in 30 holes that was exploded with three shots and left a mass of concrete shattered so that it would be removed by the derrick. Afterwards men started cutting out the rivets in the two 9-foot by-pass pipes and they were disassembled.



CONSTRUCTION OF CUT-OFF TRENCH.

PROGRESS OF THE WORK

At the beginning of the year 1921 the $2,000,000 worth of work required to be finished at that time by the contract schedule had been completed and thereafter the progress was somewhat in excess of the contract requirements until the end of the year, when it was more than $100,000 in excess of the $3,000,000 worth then required. During the year the average number of men engaged varied from

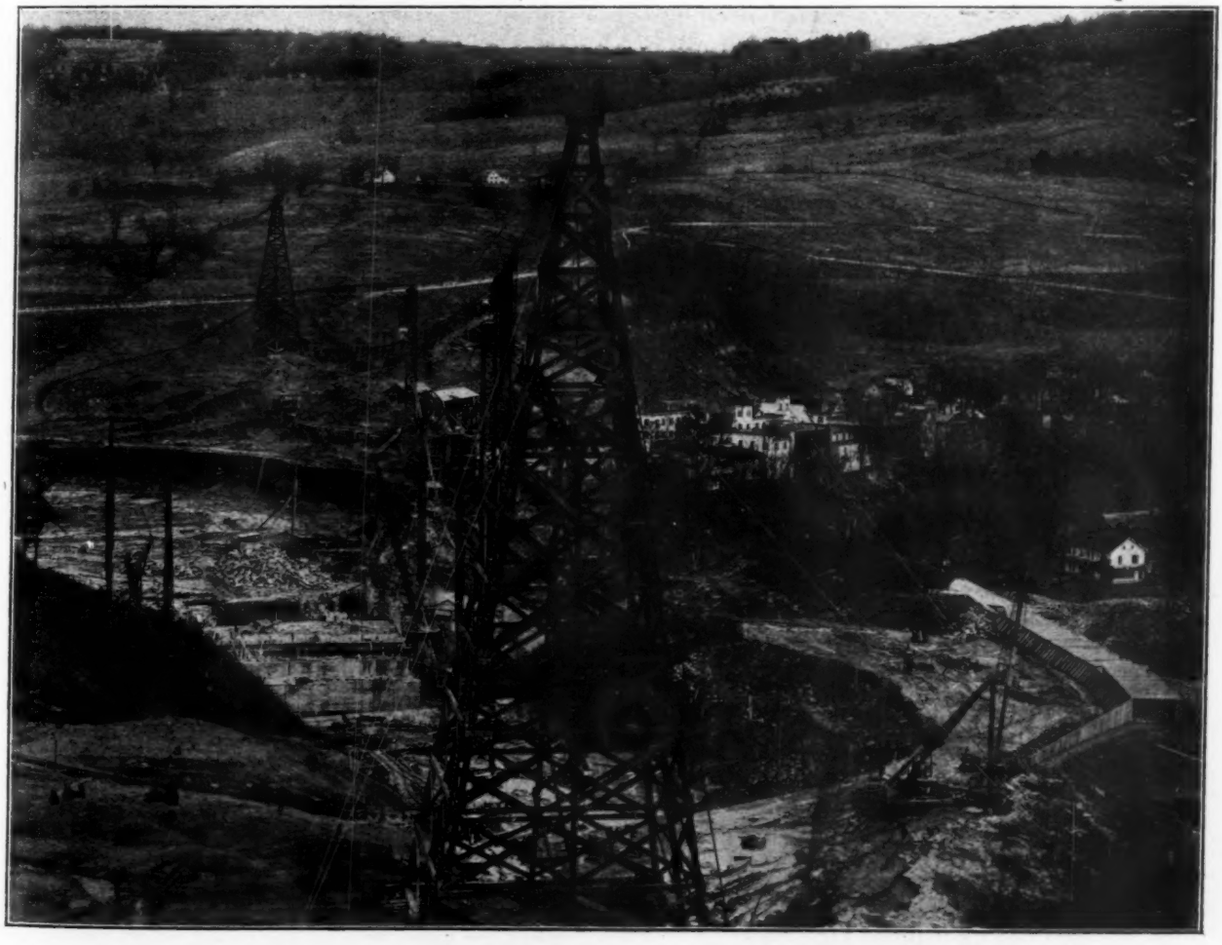
about 100 in January to a little less in December, with a maximum of 540 in September. The number of animals employed varied from 20 to 50.

Work was executed under the direction of Geo. G. Honness, department engineer, James A. Guthridge, division engineer, John D. Groves, senior section engineer, and Louis E. Robbe, section engineer in charge of the dam. Under them, there was a force of 23 assistant engineers, transit men, axe men, inspectors, office employees and others. The contractors' force included N. S. Brock, works manager; James McManus, superintendent, and G. J. Lewis and J. T. Fitzgerald, engineers. The contractor provided dwellings for some of his staff, barracks for the laborers, a commissary and an emergency hospital. The sanitary condition of the camp has been excellent, garbage has been regularly collected and disposed of by burning and by burying in distant pits.

CONSTRUCTION PLANT

The principal items of plant installed for the construction of the dam and for the adjacent roadwork in the reservoir were as follows:

Two Atlantic steam shovels with 2½-yard buckets; four Thew shovels with 2½, ¾ and ⅝-yard buckets; one 42 x 48-inch Traylor Bull Dog crusher; two Traylor gyratory crushers; one 9 x 15-inch Climax jaw crusher; one Climax portable screening and crusher bin; one Austin gyratory crusher; two cylindrical and two cubical concrete mixers with capacities from 6 cubic feet to 2 cubic yards, which were driven by gasoline, steam and electricity; one 10-ton Buffalo roller; one 10-ton Monarch roller; one 12-ton Austin roller; one 20-ton Monarch tractor, and one 2-horse roller; four 15-ton and one 18-ton Dinkey locomotives; twelve vertical and two horizontal steam boilers of 15 to 100 h.p. each; nine Worthington and Warner duplex steam pumps of 3 to 6 inches; five 4 to 10-inch centrifugal electrical driven pumps; three 3-inch diaphragm pumps and four 3-inch hand pumps; two Ingersoll-Rand and one Sullivan channeling machines; twenty-one single and double-drum hoisting engines of the Lidgerwood, Lambert, Lakewood and Mundy types; two Linn 5-ton tractors; one 2-ton Autotruck; two trailers; three Boston caravans; two touring cars; twelve single and five double dump carts; twenty-seven 1½-yard and 2-yard bottom dump wagons; thirty-five 4-yard railroad dump cars; twelve 1½-yard railroad dump cars; eight slip scrapers; twenty 3-yard and six 1-yard skips; six 1-yard Stuebner buckets; several wagons and buggies; fifty-six horses; two water carts; 8,750 linear feet of narrow-gage railroad track; 3,000 linear feet of 50-pound rails; four Ingersoll-Rand air compressors; two portable compressors; three air tanks; four steel guy derricks with 100-foot booms; one steel guy derrick with 90-foot boom; one stiffleg derrick; four travelling derricks with 65 and 75-foot booms; one wooden stiffleg; one wooden guy derrick and two hand crab derricks; one 1,900-foot span cableway on main dam; one stone aerial tramway, 3,670 feet long with ten intermediate towers; one



GENERAL VIEW OF CONSTRUCTION WORK ON GILBOA DAM.
Channel excavation is shown under way at the left.

stone aerial tramway 2,650 long with two 4,100 foot cables and one 7,500-foot cable and three 1 1/9-yard buckets; one 3,300-foot cement aerial tramway with two 3,600-foot and one 6,700-foot cables and 14 1/3 cubic yard buckets, and one 585-foot aerial sand tramway with a 1,400-foot and a 1,200-foot cable and two 1½-yard buckets; two concrete hoisting towers and cables; six 24-inch and one 12-inch belt conveyors; one No. 14 electric driven cyclone well drill; 2,500 linear feet of spiral riveted pipe; 10,000 linear feet of 4-inch air pipe; 200,000 feet of weatherproof covered copper wire; 20,000 feet of hard drawn copper wire; four riveting guns; two chipping guns; three giant air drills; nine Oldham plug drills; one Oldham surface cutting drill; nine tripod drills; fourteen jackhammer drills; two blasting machines; six air augers; eight carbide lights; twenty-two stoves; six sheet pile driving hammers; an acetylene welding outfit; three Caniff grout pans; three 30-ton jacks; fourteen small jacks; a clamshell bucket; an orange peel bucket; 2,000 shovels; 1,000 picks; 5,000 feet of water pipe 1½- and 2-inches diameter; 2,400 feet of 4-inch water pipe; 8,000 feet 6-inch; 2,000 25-W. electric bulbs; two 2½-h.p. gas engines; two 1-h.p. gas engines.

Machine shop No. 1 and Blacksmith shop No. 1 were equipped with a screw machine, lathe, upright drill press, planer, trip hammer, bolt threading machine, bolt cutting machine, hydraulic press, forges and hand tools. Blacksmith Shop No. 2 was equipped with a drill sharpener, forge, electric blower and hand tools. Blacksmith Shop No. 3 had a forge, electric blower and hand tools. Blacksmith Shops Nos. 4 and 5 had portable forges and hand tools. The carpenter shop was equipped with two circular saws, a hand saw, lathe, two planers, jointer, edger and reserve circular and band saws and with hand tools. There were three direct current generators, fourteen electric transformers of 1½ to 333 kva. and 45 electric motors of from 1 to 300 h.p.

State Licensing of Engineers

Summary of the requirements of the laws of the sixteen states that require the licensing of engineers. Who must be licensed and who are exempted.

During the past few weeks we have been collecting, through the courtesy of engineers and other officials of the various state boards of health, the requirements and wishes of such boards in relation to the preparing of plans for sewerage and water works systems and plants, in order that engineers in the various states may know the proper and most desirable procedure when called upon to prepare plans of this kind for municipalities or other communities or public corporations.

The state boards have cordially co-operated with us in this matter, many of them expressing their gratification that we are endeavoring to inform engineers of their regulations and wishes, believing that it will make for more cordial relations between the boards and the engineers and avoid friction which sometimes arises from lack of knowledge on the part of the engineers as to the regulations of the health boards. In collecting this information we originally had in mind the consulting engineers who are called upon to practice in many states other than that in which they live, but found that a great many engineers, either consulting or engineers of cities and smaller communities, are ignorant of the health regulations of their own state.

One of the first regulations of engineering to be considered is the State regulation found in many of the states requiring the licensing of engineers. We are, therefore, presenting as preliminary to a consideration of state health board regulations, a summary of the requirements of the license laws of the several states. While we were still engaged in preparing this we obtained a copy of a compilation of these laws made by the American Association of Engineers, and desire to give credit to this compilation for assistance in perfecting this brief summary.

STATES REQUIRING LICENSES

Up to the present time, sixteen states have passed laws requiring the licensing of engineers, most of the states including also surveyors and some of them architects as well. These states, in the order in which they passed the engineering license laws, are as follows: Florida, Iowa, Michigan, Louisiana, Virginia, North Carolina, Arizona, Indiana, Colorado, Tennessee, New Jersey, Minnesota, New York, Oregon, Pennsylvania and West Virginia. These laws, requiring the licensing of engineers, have already gone into effect in all of these states except Tennessee, where the law becomes effective on April 9th of this year; New Jersey, where it becomes effective in April, 1923; New York, where it becomes effective May 5th, 1923, and Pennsylvania, where it becomes effective June 1, 1922.

THOSE REQUIRED TO BE LICENSED

The law refers to professional engineers in each of these states and in addition, to surveyors in all but Florida, Tennessee, Oregon and West Virginia. In the majority of cases the license is required for either practicing or offering to practice. We understand the distinction between practicing and offering to practice to be that an engineer may, in the states named, endeavor to obtain employment as an engineer without a license, but cannot actually engage in work until the license has been secured.

In addition to engineers and surveyors, a number of states required licenses under the same law for architects.

EXEMPTIONS

There are a number of limitations and exemptions, the most important of which affect those engineers who wish to do work in states in which they do not reside. Tennessee, Oregon and Pennsylvania have exemptions not found in the other state laws, in that their laws do not require registration for the purpose of practicing architecture or engineering "unless the same involves the public safety or health, provided he does not use the appellation architect or engineer," according to the Tennessee law; or for

"other than public utilities, on property owned or leased by said individual, firm or corporation . . . or which affects exclusively the property interests of said individual, firm or corporation, unless the public safety or health is involved" in the state of Oregon, and, in the state of Pennsylvania, registration is not required for practicing engineering or land surveying "by any person or firm or co-partnership or corporation upon property owned or leased by such person, firm, co-partnership or corporation, unless the same involves the public safety or health."

Engineers of the United States government are exempted from the law in Florida, Iowa, North Carolina, Arizona, Indiana, Colorado, Tennessee, New Jersey, Minnesota, New York, Oregon, Pennsylvania and West Virginia. Exemption is also granted to employees of corporations engaged in interstate commerce, such as railroads and others, except in Florida, Iowa, Louisiana, Virginia, North Carolina, Arizona, Indiana, Colorado, Minnesota, New York and Oregon.

An engineer may offer his services without first obtaining a license in Indiana, Colorado, Minnesota, New York, Oregon, Pennsylvania and West Virginia. Should work be obtained in these states, however, a license is required unless there is exemption under other clauses.

Most of the states have provisions for those who have recently moved into the state, permitting them to practice immediately upon their taking up residence provided that they apply at once for a license and pay the license fee. Several of the state laws include provisions that engineers in the employ of the state or any political sub-division thereof at the time the Act becomes effective may continue in such employment without a license until the expiration of their term of office. Registration is not required for an engineer serving as an employee of a registered engineer in North Carolina, Arizona, Indiana, Colorado, Tennessee, New Jersey, New York, Oregon, Pennsylvania and West Virginia.

Several of the states have exemptions peculiar to themselves. For instance, in Colorado, registration is not required of an engineer or architect who had been in the practice of his profession prior to the passage of this Act, provided that he does not represent himself as a "registered architect" or "registered professional engineer." The same state exempts performing architectural or engineering work by a person who is not an architect or an engineer and who does not represent himself to be such.

In Virginia, license is not required of an engineer who practices engineering solely as an employee of the state or any political subdivision thereof, or of any corporation, firm or individual when such engineer's time is devoted exclusively to such employment and such engineer does not offer his services to the public generally for hire; also any engineer who does not represent himself as a "registered professional engineer."

In Indiana, license is not required for a "duly elected and qualified county surveyor." In Minnesota, registration is not required of "any person selected by any municipality or public authority to perform public work in the state of Minnesota."

(To be continued)

Sludge Reduction at the Baltimore Sewage Treatment Plant

By C. E. Keefer *

A large part of the sludge is bought from the city by a private company, which dries, grinds and screens it and sells it as fertilizer.

One of the biggest problems that has confronted Baltimore in its treatment of sewage has been the sanitary and efficient disposal of its sludge. At the sewage treatment works there are four settling tanks, in which the sludge is collected. From them it is pumped into 20 sludge digestion tanks, which have a total capacity of 1,171,000 cu. ft. In these tanks the sludge is digested until, at the end of five or six months, the volume has been decreased about 42 per cent, and the sludge no longer has an objectionable odor. It is pumped from these tanks onto sand beds to a depth of approximately 12 inches, where it remains three weeks or longer, depending upon weather conditions, until its moisture content has been reduced to about 65 per cent.

After being removed from the drying beds, the sludge has been disposed of by selling it to farmers and to a reduction company. During the first few years that the treatment plant was in operation, the sale to farmers was large, totaling over 7,000 wagon loads in 1915. At present the sludge is sold for 25 cents a load. Some of the farmers claim that the sludge gives satisfactory results, while others, who have not learned the best methods of applying it, consider it detrimental to the soil.

The farmers now take air-dried sludge together with small amounts of the dried scum from the digestion tanks. Wet sludge containing about 90% moisture is also sold. There is a decided advantage to the farmers in using wet sludge as they can more easily fill their wagons by gravity from a standpipe which has been provided for them. The amount of sludge that the farmers take away, however, fluctuates widely due to weather conditions, the kind of crops they are raising, the price and supply of manure and garbage, or other fertilizers, the labor market, and the ease with which they can haul the sludge from the plant. Recently facilities have been provided so that the farmers have less trouble in loading their wagons with air-dried sludge.

PRIVATELY OWNED REDUCTION PLANT

About the time the sewage treatment works were completed and for some time previous, numerous propositions were made to the city for disposing of the sludge, some of which consisted of the manufacture of soap, producer gas, and fertilizer. In 1916 a 5-year contract was made with a privately owned reduction company for the reduction and final disposal of the sludge. The contract provided that the reduction company would build its own

* Assistant designing engineer, Sewer Division, Highways Department, Baltimore, Md.

plant, and pay 81 cents a ton (2,000 lbs.) for sludge containing, after drying, approximately 15 per cent moisture; no payment to be made, however, if the nitrogen as equivalent ammonia fell below 2 per cent.

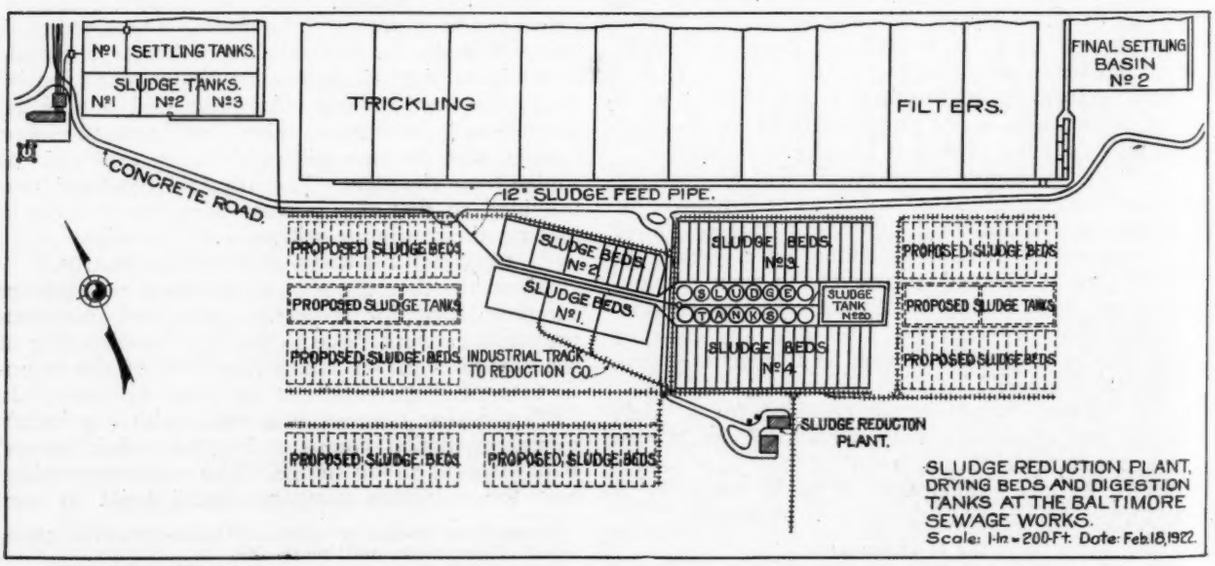
The reduction company is on the property of the city, for which there was an annual rental charge of $250. The plant was situated adjacent to the sludge-drying beds for the convenience of both parties. In the main the plant consists of a hand-fired brick furnace, two rotary driers, and a cylindrical screen. The sludge is hauled on a trestle by a 3-ton Plymouth locomotive from the drying beds in one-yard industrial cars, and is dumped in piles adjacent to the reduction plant. The sludge, which contains about 65 per cent moisture, is then shoveled by hand into a conveyor. This conveyor consists of a trough, which is built on an incline over the top of a furnace. An endless chain, to which are attached blades, 18 in. by 4 in., lifts the sludge so that it falls through the flames of the furnace into the drier. With one drier in operation approximately 4 tons of coal are used per day, and from 14 to 18 tons of dried material are produced. Ten laborers and one superintendent are employed to operate the plant.

Of the two driers at the plant, only one has been operated recently. Both are of the Renneberg make, one being 50 ft. long and 5 ft. in diameter, and the other 40 ft. long and 6 ft. in diameter. Each drier is made of heavy boiler plate. The drier rests on rollers, and is provided with gearing for rotating it, and the sludge which enters gradually works its way to the other end, the drier being built on a slight incline away from the furnace. There are stationary shelves or blades on the interior, which the dried sludge follows. From the drier the sludge drops into a dust box constructed of brick. After leaving the dust box, the sludge is carried through a rectangular trough conveyor to a revolving screen 12 ft. long and 4 ft. in diameter. This screen is covered with wire mesh having 5 openings per inch each way. After passing through the screen, which collects large particles such as match sticks, pebbles, and other large objects, the sludge is carried to a grinder, where small lumps are ground. This ground material is returned to another screen, and is finally put in bags for shipping, each bag when full weighing from 50 to 75 pounds. The dried sludge has a moisture content averaging from 12 to 18 per cent. After drying it averages about 2 per cent of nitrogen as equivalent ammonia, and contains from 4 to 5 per cent of grease. The dried material, since it has a great affinity for water, gives excellent results when it is used as a filler for fertilizer.

When the plant was first put in operation, many difficulties were encountered, and a good deal of experimenting was necessary before satisfactory operating results were obtained. The first cost of the reduction plant was $15,292.64. It had been in service about a year when it was destroyed by fire, and was rebuilt at a cost of $13,037.71. The plant had been in continuous operation since the fire until the contract expired on January 31st, 1921. Table 1 gives the yearly quantities of sludge that have collected in the settling tanks, the amount delivered to the reduction plant, and the amount sold to farmers. Within the past few months the company that owned the reduction plant has made a number of repairs to their machinery, and are continuing to dry sludge by the same methods that they used previously.

At the termination of the contract with the reduction company in January, 1921, several schemes were considered for the final disposal of the sludge. As it accumulates at the rate of 16,000 or 18,000 cu. yds. (65% moisture) per year the problem was a large one. It might have been permissible to dispose of it in the Chesapeake Bay if this body of water had not been one of the centers of the shellfish industry. The cost of carrying it to the Atlantic Ocean, a tow of 170 miles, would have been prohibitive, as it would have been necessary to lay two or three thousand feet of pipe line, to purchase specially constructed barges for holding the sludge, and to dredge several miles of channel to the Chesapeake Bay.

Several of the farmers in the vicinity of the sewage treatment works were interviewed. Some of them said that they found the sludge of value and



SHOWING LOCATION OF SLUDGE REDUCTION PLANT AT BALTIMORE SEWAGE WORKS.

would buy it, while others showed little interest in using it. From past experience it has been demonstrated that no great reliance can be placed on the quantity that the farmers will take, for which reason some more permanent and sure method of sludge disposal had to be looked for.

The sewage treatment works are under the supervision of A. E. Christhilf, highways engineer, with M. J. Ruark, division engineer of sewers, and J. W. Holden, superintendent of the plant. H. G. Perring is chief engineer of the Department of Public Improvements.

St. Louis' Proposed Water Works

The city of St. Louis, or at least the officials of the water department, have under consideration the construction of additional water works to supplement the present supply. The general design of the proposed works has been fairly well worked out, but the details will not be ready for publication for some time. A vote will be taken on the issuance of bonds for this purpose, the amount asked for being $12,000,000, which is estimated to be sufficient for the first installation.

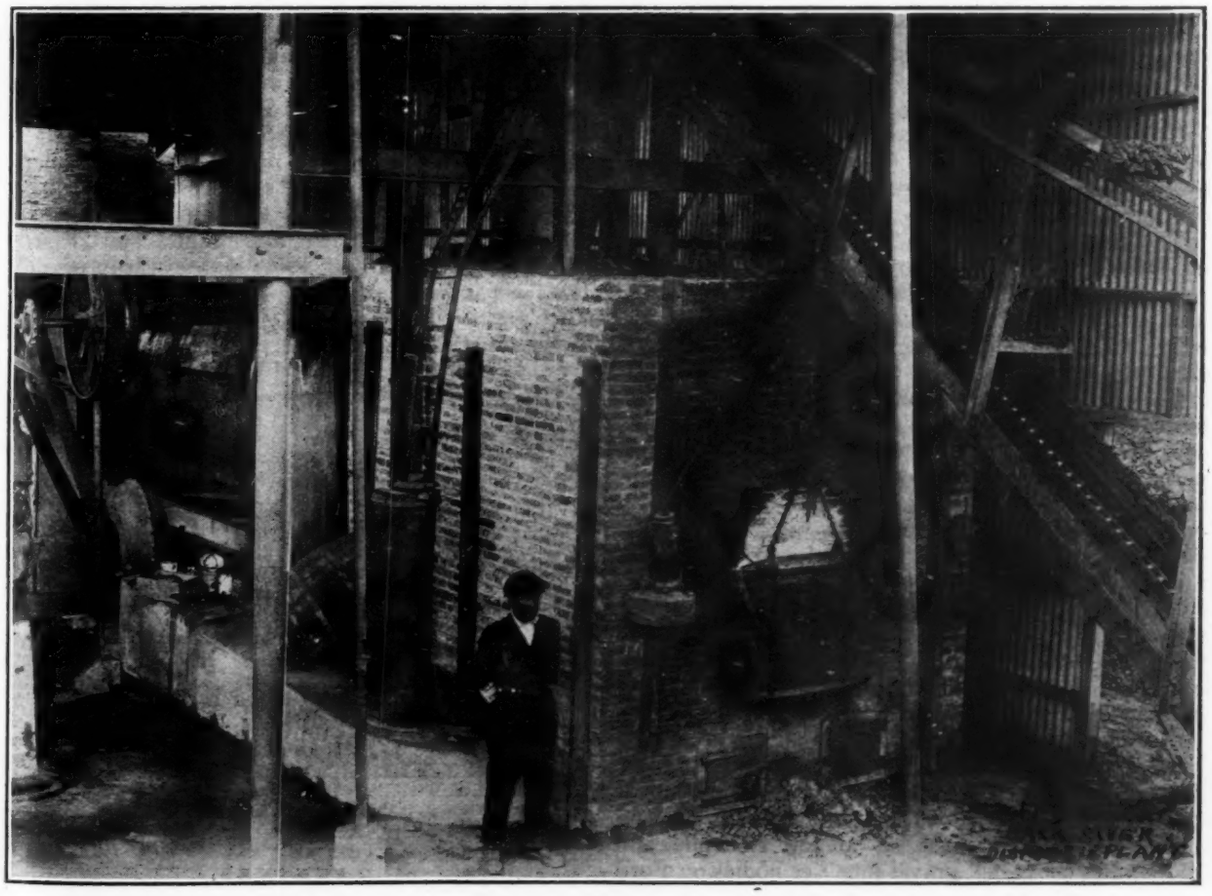
Some of the general features of the supplementary works, we are informed by Edward E. Wall, water commissioner, are as follows:

The new works will probably be built on the Missouri river and be designed for an ultimate capacity of 200,000,000 gallons per day. Some portions will be built of full size for the completed works, such as the intake, conduits and some of the buildings, also a part of the basins and the grit and mixing chambers. Other portions, of course, can be built a section at a time as the demands develop.

The proposed system is divided into five sections—the river plant, plant equipment, supply mains, reservoir, and service main.

QUANTITIES OF SLUDGE OBTAINED AT THE BACK RIVER SEWAGE TREATMENT WORKS

	Quantities of Digested Primary Sedimentation Tank Sludge Produced in Cubic Yards		Quantities of Primary Sedimentation Tank Sludge Disposed Of				
			Delivered to the Reduction Co., Cubic Yds.	Sold to the Reduction Co.		Sold to Farmers' Loads	
Year	90% Mois.	65% Mois.	65% Mois.	Tons	Mois. %	Wet, 90% Mois.	Dry
1912	6,568	1,877	.....	.....	.....	.....	.....
1913	11,348	3,242	.....	.....	.....	.....	.....
1914	32,233	9,209	.....	.....	.....	5100	.....
1915	47,010	13,431	.....	.....	.....	7178.5	483.5
1916	53,040	15,154	13,631	2527.56	13.87	4048	343.5
1917	51,029	14,580	12,848	1200.09	12.04	847	544.5
1918	64,025	18,293	12,805	3640.09	16.30	316	912
1919	59,886	17,110	16,377	2462.94	16.65	13	.....
1920	57,223	16,349	19,322	1645.69	16.26	564	37



INTERIOR OF ONE OF THE SLUDGE REDUCTION PLANT BUILDINGS.

The river plant includes the land, the necessary protection work on the river, intake, engine house, boiler house, grit chamber, mixing conduit, settling basins, filter plant, and other minor buildings, conduits, etc. The estimated cost of this section is $3,711,000.

The plant equipment includes high and low service pumps with their auxiliaries, boilers, engine shops, locomotives, and filter plant equipment. This is estimated to cost $1,447,000.

The supply main section includes one 72-inch steel main 9 miles long and the land and right-of-way necessary for it. The estimated cost of this is $1,589,000.

The reservoir will be of concrete with a capacity for 100,000,000 gallons and the cost of building this and of the land for it is estimated at $1,130,000.

The service main comprises two 72-inch steel lines each 5 miles long, and cast iron mains necessary for connecting up the distribution system. This and the land necessary for the right-of-way are estimated to cost $3,133,000.

Sand and Gravel Rehandled for Concrete Road

Aggregate stored alongside the subgrade at frequent intervals and delivered to mixer by small trucks, loaded by mechanical equipment.

The 4-mile section of the Edwardsburg highway in St. Joe county, Ind., has a 16-foot surface, 8 inches to 6 inches thick of 1:1 ½:3 concrete placed by the Rieth-Riley Construction Co., Goshen, Ind., contractor.

The aggregate was hauled from South Bend, Ind. in 7-yard trucks, 8 miles over well oiled macadam roads, dumped in stock piles about 2,000 feet apart located by the roadside adjacent to the subgrade either at road intersections or in convenient places along the right of way.

The material was economically transported in large units before the construction season opened, thus practically securing additional working time and permitting the accumulation in advance of a large amount of material available close to the points where it would be used, and consequently reducing delays, uncertainties and interruptions to the work after the paving was commenced.

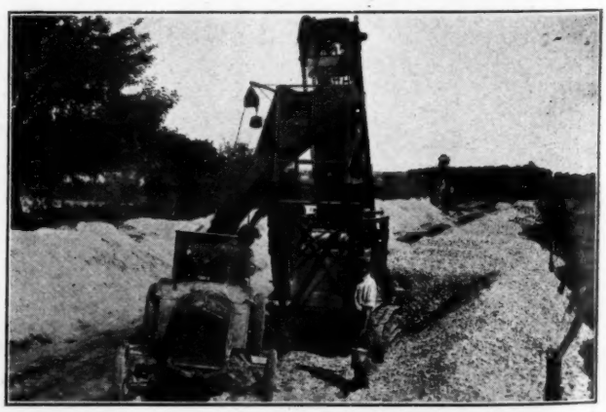
Preliminary distribution was begun before the smooth old road was put out of commission, facilitating the transportation and avoiding injury or extra difficulties that would have been involved by hauling it over the soft subgrade.

Grading was commenced at the end of the section most remote from South Bend and after about 2,000 feet of it had been completed, up to the first stockpile, a Barber-Green loader, equipped with a measuring hopper, was installed at the stockpile and measured and loaded gravel into Lee bodies on Ford trucks, proceeded to the next stockpile and so on. Another Barber-Green loader measured and loaded the required amount of sand into the trucks, five of which were continuously occupied in delivering to the mixing machine, where they backed up and dumped into the charging skip. A sixth truck was kept in reserve in order to maintain full service and avoid interruption in case any truck was temporarily delayed by breakdowns or repairs.

Ordinarily the cement was hauled as needed in large trucks and stored on platforms on the shoulders adjacent to the paver; but when the subgrade was too sandy to carry the heavy trucks, the cement was carried with the sand and gravel, delivered from the stockpiles.

The system of rehandling was found very flexible and economical because with it the materials were cleaned up absolutely at each stockpile, after which the loaders moved to the next piles and without extra cost equalized any variations in the original distributions of material. The cost of rehandling with the smaller trucks was considered to be more than offset by the saving due to making the long haul with large units. This also had the advantage of eliminating delays likely to occur in long-haul operations, and in being flexible and easily adapted to varying conditions as well as making all of the work easily seen and directed by a single superintendent. It also eliminated much of the interdependence of consecutive operations and made the different portions of the work more nearly independent and responsible for their own progress.

The work was executed by 29 men, including covering, 1 man and team for forms, etc., 1 extra man to help team, 1 finisher edger, 1 machine tamper engineer, 1 man in wet concrete, 1 mixer engineer, 1 mixer fireman, 3 cement men, 5 Ford drivers, 2 men on forms, 2 men fine grade, 2 Barber-Greene loaders operators, 2 B-G loader helpers on gravel, 1 B-G loader helper on sand, 1 mechanic, I pumpman, and 1 foreman. They made a daily average of 672 square yards or 137 cubic yards in 10 hours, which means that a batch was turned out every 2 minutes and 28 seconds. A maximum of 1172 square yards or 239 cubic yards was laid in 10 hours, which means a batch every 85 seconds. The work was under the direct supervision of Harley A. Firestone.



SAND AND GRAVEL STORED ALONGSIDE HIGHWAY AND DELIVERED TO MIXER BY SHORT-HAUL MOTOR TRUCKS AND TWO LOADING MACHINES.

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A. PRESCOTT FOLWELL, Editor
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Licensing of Engineers

Engineers are divided in their opinions as to the desirability of a system of State licensing of engineers, and substantial arguments are presented both pro and con. New England seems to be solidly against the idea, and a proposed licensing law was defeated in Massachusetts last year, being actively opposed by most if not all engineering societies of the State except the American Association of Engineers. With this exception, however, the sixteen States that have adopted licensing are scattered over the entire country from Arizona and Oregon to New York and Florida, and from Michigan to Louisiana.

The movement for such laws is of comparatively recent development, the first one—that of Florida—having been passed in 1917, and only five having been passed prior to 1921.

These laws require all engineers (except those connected with the army and the railroads) to be licensed before they can practice, although one State exempts those employed by municipalities.

The arguments for licensing are valid, in our opinion, only insofar as they are based upon securing engineering efficiency and protecting the public, and not for use of the license as a method of raising revenue. The former aim depends for its fulfilment upon the employment of informed judgment and common sense in the granting of licenses. That these will not always be employed is evident by the requirements of some of the laws. The Louisiana laws require the granting of a certificate for civil engineering to any one who is 21 years of age, of good moral character and who shall pass a satisfactory examination in "plane trigonometry, plane surveying, practical use of instruments, and in addition thereto, natural philosophy or physics, including practical problems in design and construction." We wonder where the framers of this law obtained their idea of what constituted an engineering education.

To engineers in general practice — consulting engineers—the matter of state licensing presents a problem, for they must take out a license in every state in which they desire to practice. In most of the license states a license must be had before *offering* to practice. It might be thought that this would be met by a reciprocity, as is done in the case of automobile licenses. Each of the states grants a so-called reciprocity in the case of other states whose requirements equal its own. (That would exclude Louisiana from reciprocity with every other state, we hope). But this reciprocity merely exempts the non-resident applicant from examination for a license. He must still take out a license in each state, after presenting legal proof of his possession of a license in his own state, and pay the full license fee in each.

Moreover, each state requires reciprocity. If New York will not recognize a Louisiana license, then Louisiana cannot recognize one granted by New York, and we will have the absurd spectacle of one of the leading engineers of New York, called in consultation by New Orleans, being required to pass an examination in geometry, trigonometry and physics before he can render such service.

The matter of reciprocity will probably be taken up by the National Council of State Boards of Engineering Examiners, when it meets in October, and it is to be hoped that the general adoption of more reasonable provisions in this respect will be arranged for.

Refuse Collection as a Science

Refuse collection is gradually becoming a science —"knowledge classified and made available in work;" but the amount of classified knowledge, or exact knowledge of any kind, is still distressingly meagre. Of quantities as determined by actual weights, measurements and analysis of the refuse collected few municipalities have any records taken even occasionally, and almost none have complete continuous records. But until such records are available the science of collecting will be a very hazy one and efficiency will depend largely upon chance.

The analysis made of conditions, experiences and costs in St. Paul by the engineer of the Bureau of Municipal Research and published in PUBLIC WORKS for March 11th and 18th is one of the comparatively few studies of this kind which contribute a large part of the fundamental data from which the science of refuse collection must be developed.

In this discussion the author brings out the importance of knowing the exact average time required for making a collection, or the average number of collections per hour, in different classes of districts —sparsely residence, compact residence, business,

etc. Every superintendent of collection could learn these time units for his own city, and if all would do so and make their knowledge public the gain to the science would be great.

Amount of Street Sweepings in St. Louis

By Zara Witkin*

Explanation of greater amounts picked up after rain than in dry weather.

The recent report of the five-year period of suction street sweeping operation in the city of St. Louis in the issue of PUBLIC WORKS for February 4th included data indicating that the amount of street dirt picked up after a rain was greater than the amount removed from the same area in dry weather. This apparent paradox is given at the end of the report in a question asking for an explanation of "the increase of street dirt after a rain."

The explanation given below is based upon a consideration of the probable traffic and pavement conditions and the agents and forces functioning in the deposition, retention and removal of street dirt.

NORMAL OPERATING CONDITIONS

The suction sweeper operated in the shopping districts. The pavement characteristics of metropolitan shopping districts are usually smooth, hard pavement, light grades, well-crowned and maintained surface. Traffic in the same class of streets is usually made up of a minimum percentage of horse-drawn and a maximum percentage of motor vehicles.

Owing to these conditions, street dirt in the shopping districts is composed of a larger percentage of small size fragments or particles than in other heavy-traffic districts.

The data in the St. Louis report referred to dirt removed from the central part of the street, not including the gutter strips, in this case each nine feet wide from the curb. Comparisons were made between dry days and rainy days on the same area.

Assume equal amounts of dirt on this area in the central portion of the street at the same time on different days. (This practical equality is shown by the data.)

FACTORS AFFECTING DISTRIBUTION OF STREET DIRT IN DRY WEATHER

On a dry day three agents are continually at work dispelling this dirt from the central part of the street and distributing it in the gutters, over the sidewalks and building fronts, and into the atmosphere as dust. These agents are:

1. Street cars or motor traffic, which by suction action raise small fragments and dust and throw this material to either side and eventually into the gutters. Every pedestrian is familiar with the automobile's cloud of dust, and its effects. Even the casual observer will notice a marked difference in the cleanliness of the "traffic lanes" as compared with the gutters.

*Engineer, San Francisco Bureau of Governmental Research.

2. Wind, which, on smooth pavement, constantly sweeps the central area and deposits dust, papers, etc. in the gutters and raises some into the atmosphere.

3. The sun, which dries moist street dirt, such as horse droppings, after which traffic breaks it up into fragments and dust, and it is impelled into the gutters as described above.

These three agencies combine to cause a reduction in the amount of street dirt in the central portion of the street from the total amount deposited thereon in dry weather. In wet weather, however, the disposition of this dirt is quite different. None of the agencies considered above are active as in dry weather.

FACTORS AFFECTING DISTRIBUTION OF STREET DIRT IN WET WEATHER

The effects of rain on smooth pavement is to mix with the dirt deposited on it, making a thin, slimy mud which sticks to the surface. This mud is not removed by any but very heavy rains and remains to cause the danger of skidding, to traffic. Of course a very heavy rain does wash away some of the dirt deposited in the center of the street but as a matter of observation this scouring effect is not shown by lighter rains, which serve to moisten the dirt and paste it to the pavement. This is exhibited in the tabular analysis of the St. Louis data.

Analysis of St. Louis Dry Weather and After Rain Pickup Data

	OBSERVATION		
	1	2	3
Cu. yd. picked up, dry weather	2.18	2.11	2.78
Cu. yd. picked up, after rain..	3.92	3.19	3.18
Rain began	..	..	1.30 P.M.
Rain ended	4.00 P.M.	9.00 P.M.	3.00 P.M.
Intensity of rain	..	..	Heavy, 0.81 in.
Sweeper began	8.15 P.M.	1.30 P. M.	7.30 P.M.
Time interval, end of rain to start of sweeping.....	4¼ hr.	4½ hr.	4½ hr.
Cu. yd. difference between after rain pickup and dry weather pickup	1.74	1.08[2]	0.40[1]
Per cent. difference.....	44.3	34.0[2]	12.6[1]

[1]Due to scouring effect of extra heavy rain, not occurring in other cases.

[2]Greater time interval between end of rain and beginning of sweeping, allowing dry weather "removing" agents to take some effect.

The only method which will remove this slime while still wet, is the application of high pressure water streams at a low angle to the pavement surface, by hand hose, or flusher.* Further, traffic tracks dirt from dirtier streets and from the gutters into the "traffic lanes" in wet weather. Rain, in falling, carries down with it the great percentage of the dust in the air, which in a large city exists in considerable amount. Also, the wet surface of the

*Even streams of water under high pressure and directed in accordance with good flushing practice fail to remove a considerable percentage of the dust on the central area of the street. Careful tests made by the Los Angeles Efficiency Commission in 1916 demonstrated this. Their observations under ordinary operating conditions were, for the central strip excluding gutters:

1. That neither horse-drawn nor motor flushers remove all of the dust.
2. The motor flusher removes from 15 per cent to 40 per cent, averaging about 25 per cent of the dust.
3. The horse-drawn flusher removes 45 per cent to 75 per cent, averaging about 55 per cent of the dust. (This is due to the slower speed and consequently greater effective flushing service of the horse-drawn flusher.)

pavement catches and holds the dust which setttles afterwards. Another factor in the greater amount of street dirt picked up after a rain from the center of the street is the quantity of moisture retained in the "dried" particles. On the other hand, the agents which remove dirt from the central area of the street in dry weather do not operate in a rain.

The combined effects of all these factors, operating as described, under normal conditions, will account for the difference in the amounts of street dirt picked in dry weather and after a rain, not as "the increase of street dirt after a rain," but as the amount retained on the central strip of the street by the sticky effect of wetting.

Road Work in Colorado County

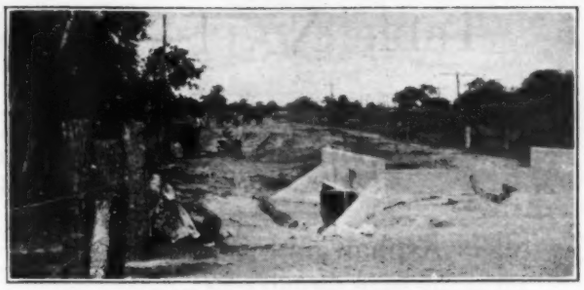
The first Texas county to complete its section of the Houston-San Antonio road. Costs and construction details.

Colorado county, Texas, was the first of the several counties through which passes State Highway No. 3, the main line between Houston and San Antonio, to complete its portion of this road. The last section of the road in that county was opened for traffic on January 15th of this year, this section being 3.8 miles long. The entire distance across the county is 40.5 miles. The road is being constructed of gravel 16 feet wide and 6 inches thick, and one mile of concrete 16 feet wide and 5-7-5 inches with 25 pounds of steel per square yard. The road bed is 24 feet wide. The bridges are constructed of concrete.

The road was let in three contracts, the first consisting of 17.12 miles and costing $129,703, including engineering, of which the government paid $44,000, the state of Texas $31,760, and the county $53,943. The second contract was for 19.66 miles, on which the government gave no aid. The third was 3.8 miles and cost $45,761, of which the government paid one-half. The average cost per mile of the first section was $7,576, of the second section $10,715, and of the third section $12,045; the average for the entire 40.5 miles being $9,554.

Two road districts were laid out, divided by the Colorado river, the other boundaries being approximately parallel with the center of the highway and taken at such distance therefrom as not to tax any lands except those which would in most cases receive some benefit. Each district was about 20 miles long by 6 miles wide and had a valuation of about $3,000,000.

Three grade crossings were eliminated by making a change of location of the road and constructing an underpass. The Colorado river is crossed at Columbus by a 700-foot steel span 18 feet wide. The floor of this bridge was made of pine, treated with 10 pounds of creosote to the cubic foot, the flooring being 2 by 4 inches placed on edge. B. H. Faber, the county engineer, to whom we are indebted for this information, believes that this is the best possible method for constructing timber floors for bridges.



STANDARD CONCRETE CULVERT.

Signs along the road were constructed of steel plates painted and mounted on concrete posts. One of these is placed at each county boundary, giving the name of the county and the distance to the nearest town and a similar one is placed at each town giving the name of the town. These signs are 14 inches by 24 inches and contain white letters three inches high on a black background. Warning signs are placed on each side of the railroad track, made of triangular sheets. Dangerous curves and high embankments are warned against by signs and guard fences are constructed of 6-inch posts of mountain cedar and pine boards 2 by 6 and 4 by 4, painted white.

COUNTY LINE ROAD SIGN

The entire road from Houston to San Antonio is 225 miles long. Of this distance Harris county has constructed a gravel road for 14.2 miles; Fort Bond county contains 35.5 miles, but has raised no special funds for paving it, although county outfits are constructing a dirt road. Wharton county has 12½ miles of bituminous gravel road under construction. Colorado county has 39 miles of gravel and one mile of concrete. Fayette county has 22 miles under construction, and Gonzales has 35 miles of dirt road and a bridge. Guadalupe county has a bridge and has under construction 36 miles of gravel of its 40 miles. Bexar county has under construction 17½ miles.

GRAVEL ROAD; GUARD FENCE IN DISTANCE.

Table No. 1—City Paving Done in 1921

Supplementary data to those published in the issue of February 18th, giving all returns received since the data first received were compiled. The tables will be continued through the next two or three issues.

I—Sheet Asphalt and Asphalt Concrete

Name of City	Warrenite-Bitulithic Area	Warrenite-Bitulithic Cost	Concrete Area	Concrete Cost
California:				
Chico	....	.....	177,030*	$0.25
Oroville	....	.....	11,830	.....
Santa Monica	36,828*	$11,818.36	....	.....
Colorado:				
Colorado Springs	....	.....	94,592	2.50
Florida:				
Jacksonville	....	.....	35,938	5.60
Illinois:				
Freeport	....	.....	15,176	57,830.20
Oak Park	33,000	192,000.00	1,963	9,987.00
Indiana:				
Logansport	50,000	5.00	....	.....
Louisiana:				
New Orleans	7,088	26,807.00	....	.....
South Highlands	....	.....	20,896	3.54
Maryland:				
Baltimore	249,750c	2.40-3.32	....	.....
Massachusetts:				
Boston	2,743	2.25	180,293	2.04
Watertown	11,000	2.50	....	.....
Worcester	....	.....	6,795	24,380.00
Michigan:				
Flint	47,000	.....	....	.....
Kalamazoo	56,800	3.18	....	.....
Muskegon	27,732	.....	....	.....
Saginaw	80,000	403,000.00	....	.....
New Jersey:				
Camden	41,000	155,800.00	....	.....
South Orange	....	.....	4,000	3.59
West New York	....	.....	13,000	3.15
New Mexico:				
Santa Fe	3,000§	.....	....	.....
North Carolina:				
Durham	63,416	279,000.00	....	.....
Ohio:				
Barberton	4,370	15,581.10	1,811	8,243.05
Canton	65,036	249,709.00	....	.....
Dayton	13,500	50,000.00	....	.....
East Cleveland	....	.....	193,630	124,566.00
Newark	42,774.84	197,028.00	6,071.21	21,017.00
Perrysburg	....	.....	25,000	75,000.00
Washington C. H.	16,000	3.23	....	.....
Oregon:				
Dallas	....	.....	9,400	2.53
Pennsylvania:				
Erie	164,608	3.40	....	.....
Philadelphia	363,424	1,202,487.00	....	.....
Sharon	22,181	93,189.00	20,205	75,825.00
South Carolina:				
Union	....	.....	2†	.....
West Virginia:				
Moundsville	....	.....	8,000	.....

II—Warrenite-Bitulithic and Concrete

Name of City	Warrenite-Bitulithic Area	Warrenite-Bitulithic Cost	Concrete Area	Concrete Cost
Alabama:				
Birmingham	22,404	.....	2,500	$2.00
Demopolis	....	.....	18,563	3.41
Mobile	....	.....	5,000	.....
Prattville	....	.....	14,000	.....
Tuscumbia	....	.....	12,200	.....
Arizona:				
Chandler	....	.....	18,787	.....
Mesa	11,073	.....	....	.....
Phoenix	150,768	.....	42,440	2.92
Tempe	31,294	.....	....	.....
Yuma	21,000	.....	....	.....
California:				
Avalon	....	.....	4,445	2.61
Bakersfield	....	.....	865§	0.30*
Berkeley	....	.....	1,890	3.15-2.52
Betteravia	....	.....	5,200	.....
Burbank	....	.....	32,416	1.76-1.96
Chico	31,258	.....	....	.....
Colusa	....	.....	2,262	.....
Dixon	21,268	.....	....	.....
El Monte	....	.....	17,996	2.16-2.70
Fowler	13,620	.....	....	.....
Fresno	36,060	.....	24,229	1.80-2.07
Gustine	31,645	.....	....	.....
Hollister	....	.....	67,529	1.71-1.91
Holtville	46,376	.....	....	.....
Inglewood	....	.....	41,029	2.43
Kingsbury	50,016	.....	....	.....
La Jolla	....	.....	6,843	.....
Lodi	36,818	.....	3,000	.....
Long Beach	....	.....	101,986	1.66-2.00
Martinez	60,055	.....	....	.....
Merced	....	.....	20,964	.....
Mill Valley	....	.....	55,710	.....
Modesto	36,802	.....	2,645	1.48-1.78
National City	....	.....	60,371	1.62-1.89
Newman	37,318	.....	1,225	.....
Obispo	....	.....	80,800	.....
Orange	....	.....	55,175	1.56
Orosi	....	.....	7,293	0.90
Oroville	11,830	.....	....	.....
Petaluma	....	.....	4,284	0.80
Paso Robles	65,126	.....	....	.....
Pomona	....	.....	4,888	1.61-1.71
Richmond	....	.....	56,653	106,000.00
Sanoma	....	.....	25,100	.....
San Anselmo	....	.....	2,355	.....
San Buenaventura	57,952	.....	....	.....
San Diego	....	.....	3,717	.....
San Jose	....	.....	5,354	.....
San Pedro	....	.....	33,823	2.97-3.33
San Rafael	....	.....	500	.....
Santa Ana	....	.....	63,828	1.83-3.37
Santa Cruz	....	.....	21,951	.....
Santa Barbara	19,564	.....	12,614	2.03
Santa Maria	....	.....	13,466	.....
Santa Monica	461,139*	.....	6,734	3.18
Seal Beach	....	.....	6,665	2.25
Susanville	23,422	.....	....	.....
Taft	....	.....	10,234	2.43-2.97
Turlock	2,402	.....	67	2.52
Upland	....	.....	3,333	.....
Venice	....	.....	21,922	2.25-3.51
Ventura	....	.....	18,372	1.71-2.09
Visalia	....	.....	121	.....
Vista	....	.....	1,552	.....
Walnut Creek	....	.....	14,002	2.34
Youngstown Tr.	....	.....	39,953	.....
Yuba City	....	.....	76,658	1.79-2.28
Colorado:				
Arvada	....	.....	6,000	2.45
Denver	....	.....	78,101	1.70-3.09
Ft. Collins	....	.....	31,437	2.37-2.46
La Junta	....	.....	30,912	2.56-2.92
Manitou	....	.....	10,971	2.44
Rifle	....	.....	9,972	.....
Rocky Ford	40,621	.....	892	.....
Sterling	63,436	.....	....	.....
Windsor	....	.....	7,042	2.28
Connecticut:				
Darien	....	.....	710	.....
Derby	....	.....	2,600	2.35
Groton	....	.....	5,910	.....
Hamden	....	.....	18,413	.....
Lebanon	....	.....	604	.....
Middletown	....	.....	4,330	.....
Wallingford	....	.....	1,200	1.50
Waterbury	....	.....	1,000	2.74
West Haven	....	.....	2,240	.....
Delaware:				
Delaware City	....	.....	693	.....
Seaford	....	.....	5,360	.....
Dist. Columbia:				
Washington	....	.....	56,351	2.28
Florida:				
Eustis	....	.....	1,000	.....
Pensacola	....	.....	4,000	3.02
Georgia:				
Americus	....	.....	13,488	.....
Atlanta	....	.....	328,355	.....
Augusta	....	.....	71,456	1.74-2.95
Columbus	....	.....	395	.....
La Grange	....	.....	56,600	2.25-2.55
Macon	....	.....	2,729	.....
Marietta	....	.....	62,500	.....
Moultrie	....	.....	468	.....
Rome	....	.....	758	.....
Savannah	....	.....	188,676	2.25-3.83
Idaho:				
Blackfoot	68,415	.....	....	.....
Coeur D'Alene	....	.....	8,260	.....
Filer	....	.....	10,800	4.20
Kimberly	19,219	.....	....	.....
Montpelier	36,621	.....	....	.....
Payette	28,293	.....	....	.....
Rexburg	32,303	.....	....	.....
Wallace	6,733	.....	....	.....

(To be continued)

Recent Legal Decisions

INDEMNITY BY STREET RAILWAY COMPANY TO CITY COVERS INQUIRIES BY ACTS OF INDEPENDENT CONTRACTORS

The Texas Commission of Appeals holds, Northern Texas Traction Co. vs. City of Polytechnic, S. W. 73, that as a municipal corporation has power to control the use of its streets, and as it may become liable to members of the public for any improper condition of such streets caused by those occupying and using them for lawful but unusual purposes, such as street railway companies, it may require indemnity from a street railway company on which to rely in case a cause of action results against it from such use and occupancy. An agreement by a street railway company to indemnify a city, from which it holds a franchise to use the streets, against judgments for personal injuries arising from such use, is not void as against public policy. Such an agreement will cover injuries to a member of the public resulting from the acts or negligence of an independent contractor, while hauling gravel for the street railway, when it is raising its tracks to conform to a change of grade by the city.

WATER BOARD NOT COMPELLED TO REIMBURSE EMPLOYE FOR DAMAGES FOR NEGLIGENT ACTS WHILE NOT ENGAGED IN ITS EMPLOYMENT

The Minnesota Supreme Court holds, State vs. Foote, 186 N. W. 230, that the funds of the board of water commissioners of the city of St. Paul are public funds in the sense that courts will prevent their appropriation for other than the legitimate purposes for which they were intended. A superintendent of mechanical equipment in the city water department, furnished with an automobile for use in the performance of his duties, collided with another automobile while driving to another part of the city where his services were needed. The occupants of the automobile recovered from him damages for their injuries, on the ground of negligence. It was held that the board of water commissioners properly refused his claim for reimbursement, his negligence not having occurred while he was engaged in actual work for the board, or in protecting its property or rights.

"CULVERTS" HELD NOT SYNONYMOUS WITH "BRIDGES"

The Mississippi Supreme Court holds that the state statute providing that boards of supervisors shall construct all bridges in their district costing over $25 does not include culverts, and the highway commissioners are authorized, with the approval of the board of supervisors, to construct culverts out of the district funds. Williamson vs. Hossley, 90 So. 184. The court cited Cleveland vs. Town of Washington, 79 Vt. 498, as holding that the words "bridges" and "culverts" are not synonymous, and Carroll County vs. Bailey, 122 Ind. 46, where it was held that a culvert is not a bridge within the meaning of the statute of Indiana requiring county commissioners to construct and repair bridges over streams and water courses.

STEP TO BREAK DROP FROM SIDEWALK TO STREET, PROPERLY CONSTRUCTED, NOT A DEFECT

In an action for personal injuries sustained while stepping off a sidewalk negligent construction by the city was charged. A drop of 7¼ inches and 5¾ inches, 13 inches in all, existed between the surface of the sidewalk at its outer edge and the surface of the paved roadway. To break the drop, the city had constructed a step or ledge, 13 inches wide, 7¼ inches below the edge of the sidewalk and 5¾ inches above the surface of the street, thus making a double curb. The reason for the unusual drop did not appear. The Ohio Supreme Court holds, City of East Cleveland v. Wald, 133 N. E. 798, that, this being an improved street of a city, the presumption would exist, in the absence of proof, that the street as well as the sidewalk conformed substantially to grades authorized by the legislative body of the city, and that the 13-inch drop at that point was a natural condition. It could not be said that the construction of a step, which was the plan of construction alleged to be unsafe, was any more dangerous than leaving a perpendicular drop of 13 inches. There was nothing hidden or obscured, but, on the contrary, all was perfectly apparent to one approaching and looking downward. Reversing a judgment for the plaintiff, the court cited several cases, Morgan v. City of Lewiston, 91 Me. 566. City of Sumner v. Scaggs, 52 Ill. App. 551, Hoyt v. City of Danbury, 69 Conn. 341, Teager v. City of Flemingsburg, 109 Ky. 746, and Miller v. City of St. Paul, 38 Minn. 134, to the effect that the existence of a step, properly constructed, from a sidewalk to the street, is not a defect, so as to render a city liable for accidents to pedestrians.

CITY COMMISSIONERS' ACCEPTANCE OF STREET PAVING HELD BINDING ON PROPERTY OWNERS

The Oklahoma Supreme Court holds, Interstate Building & Loan Co. v. Oklahoma City, 203 Pac. 172, that where, in compliance with the statute, the city commissioners award a contract for paving city streets, and, on a hearing regularly had for that purpose, adjudge acceptance of the work over the protest of the abutting property owners, such acceptance is conclusive and binding upon the property owners, in the absence of fraud, and where there is nothing more than a dispute as to whether the work has been reasonably well done.

WHAT THE TERM "PAVED ROADS" INCLUDES

The Texas Court of Civil Appeals holds, Gibson v. Davis, 236 S. W. 202, that roads covered with sand or clay or any character of material, so as to make a firm hard, smooth surface over which horses, carriages, automobiles and other vehicles may pass are "paved roads," as that term is used in the state Constitution and laws.

NEWS OF THE SOCIETIES

CALENDAR

Mar. 29-30—ILLINOIS SECTION, AMERICAN WATER WORKS ASSOCIATION. Fourteenth annual meeting. Urbana, Ill.

Apr. 3-5—NATIONAL FEDERATION OF CONSTRUCTION INDUSTRIES. Drake Hotel, Chicago.

Apr. 5-6—AMERICAN SOCIETY OF CIVIL ENGINEERS. Spring society meeting. Dayton, Ohio.

Apr. 19—NEW YORK SECTION, AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Engineering Societies Bldg., New York City.

Apr. 19-21—AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. General meeting. Chicago, Ill.

Apr. 19-21—TRI-STATE WATER AND LIGHT ASSOCIATION OF THE CAROLINAS AND GEORGIA. Spartanburg, S. C.

Apr. 25-28—BUILDING OFFICIALS' CONFERENCE. Annual meeting. Hotel Lincoln, Indianapolis, Ind.

Apr. 26-28—SOCIETY OF INDUSTRIAL ENGINEERS. National spring convention. Detroit, Mich.

Apr. 27-29—BUILDING OFFICIALS' CONFERENCE. April 27-28, Cleveland, O.; April 29, Massillon, O.; April 30, Youngstown, O.

May 8-12—AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Atlanta, Georgia.

May 15-19—AMERICAN WATER WORKS ASSOCIATION. 42d annual convention. Bellevue-Stratford Hotel, Philadelphia. Secretary, J. M. Diven, 153 W. 71st St., New York.

May 16-18—CHAMBER OF COMMERCE OF U. S. A. 10th annual meeting. Washington, D. C.

June 4-6—AMERICAN ASSOCIATION OF ENGINEERS. 8th annual convention. Salt Lake City, Utah.

June 13-16—CANADIAN GOOD ROADS ASSOCIATION. Annual convention. Victoria, B. C.

June 19-22—AMERICAN INSTITUTE OF CHEMICAL ENGINEERS. Summer meeting. Clifton Hotel, Niagara Falls.

June 26-July 1—AMERICAN SOCIETY FOR TESTING MATERIALS. 25th annual meeting. Chalfonte-Hadden Hall Hotel, Atlantic City, N. J.

Sept. 25-28—SOUTHWEST WATER WORKS ASSOCIATION. Annual convention. Hot Springs, Ark.

Oct. 9-13—AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS. Annual convention. Cleveland, Ohio.

ROCHESTER ENGINEERING SOCIETY

The Rochester Engineering Society was organized March 18, 1897, with 55 charter members of whom 17 are still present. A 25th Anniversary Bulletin was issued, announcing a series of meetings, commencing March 3rd, at the first of which there was presented by Charles E. Ogden motion pictures of the New York Barge Canal that were in February exhibited to Congressmen and Cabinet officers at Washington, in an effort to counteract propaganda of the St. Lawrence Waterway advocates and show the magnitude of the New York State canal.

On March 10th there was an anniversary smoker and regular monthly meeting providing for a sort of big family anniversary celebration gathering of an informal, get-together nature, including reminiscenses of the older members and some stereopticon slides reviewing high points in the society's history.

On the evening of March 18th there was an anniversary dinner indicating the progress of good fellowship and cooperation of the different engineering groups of Rochester, which includes the Society of Architects, Society of Technical Drafting, Rochester Chapter of the American Association of Engineers, American Institute of Electrical Engineers and American Society of Mechanical Engineers, American Society for Steel Treating and the Rochester Engineers Post of the American Legion. There was then an address by John R. Freeman, President of the American Society of Civil Engineers on "Obesrvations in China and the Far East," illustrated with lantern slides, descriptive of his recent travels as consulting engineer on the improvements of the Grand Canal of China. The banquet hall was especially decorated and various prize competition awards were announced on this occasion.

Luncheons were served on March 7th, 14th and 21st, and the speakers were respectively, Charles S. Sterling on the "New York State Canal Terminals;" LeGrand Brown on "Twenty-five years of Engineering in Rochester;" E. R. Foreman on the "Task Ahead for the Rochester Engineering Society;" and J. P. Elston on the "Construction of the Saginaw Hotel," illustrated by lantern slides. The luncheon on March 28th was addressed by Doctor John A. Lloyd on "County Work on Tuberculosis."

A radio meeting will be held March 31st for which special announcements will be made later.

The anniversary programme also announced the regular meeting of the Rochester Chapter of the American Association of Engineers on March 6th with an address by George C. Donahue on the "Progress and Development of Automobile Legislation;" a meeting on March 14th of the Engineers Post of the American Legion with supper and a special stunt programme; a meeting on March 24th of the Rochester Section of the American Institute of Electrical Engineers addressed by H. M. St. John on the "Electric Furnace; the Modern Melting Machine," which described its practical application and touch on some of the illogical and visionary matter which has interfered with its proper development; the Rochester Society of Architects held a ladies' night on March 16th, when an address was given by Henry Warren Poor on the "Domestic Architecture of France, England and Italy," illustrated by more than 200 colored lantern slides from original photographs; and the Rochester Society of Technical Draughtsmen at the regular meeting March 30th will be addressd by Virgil M. Palmer on the "Engineers' License Law—How It Will Affect the Draughtsmen."

NEW YORK SECTION AMERICAN SOCIETY OF CIVIL ENGINEERS

A joint meeting was held March 15th, in the auditorium, Engineering Societies Building, 33 West 39th street, New York City. The subject was "Development of the Port of New York." It was introduced by E. H. Outerbridge, Chairman, Port of New York Authority, and B. F. Cresson, Jr., chief engineer, Port of New York Authority, and was discussed by E. B. Temple, assistant chief engineer, Pennsylvania Railroad; J. J. Mantell, general manager, Erie Railroad; and Morris Sherrerd, consulting engineer, Newark, N. J., and others.

One of the features of the evening was the showing of a motion picture film of the Port, made by the Port Authority.

A Technical Sub-Section group conference was previously held to discuss "The Importance of the Design of Details, as Evidenced by Recent Theater Failures." Mr. James H. Edwards, assistant chief engineer, American Bridge Company, presided and introduced the subject.

BROOKLYN ENGINEERS' CLUB

At the informal library meeting on Thursday, March 16, "Engineering Aspects of the Elimination of Wastes in Industry," was discussed by J. Parke Channing, Chairman of the Committee on the Elimination of Wastes in Industry, appointed by Mr. Herbert Hoover, President of the Federated American Engineering Societies.

AMERICAN SOCIETY OF CIVIL ENGINEERS

At the spring meeting, Dayton, O., April 5th, 6th and 7th, the technical program will commence at the Wednesday morning session with the Address of Welcome, Colonel E. A. Deeds, President, Engineers' Club of Dayton, and Chairman, Board of Directors, Miami Conservancy District, and the response by John R. Freeman, President, American Society of Civil Engineers.

Following there will be technical papers and discussing "Flood Conditions in Canada" by J. G. Sullivan, President, Engineering Institute of Canada, and "The Relation of the Federal Government to National Flood Problems" by Major General Lansing H. Beach, Chief of Engineers, United States Army.

Afternoon Session—"Flood Problems in China," John R. Freeman, President, American Society of Civil Engineers; "Methods of Flood Prevention in the Mississippi Valley," J. A. Ockerson, Past-President, American Society of Civil Engineers, Member, Mississippi River Commission; "Relation of Flood Problems to Power and Irrigation Development in the Rocky Mountain States," A. P. Davis, Past-President, American Society of Civil Engineers, Director, United States Reclamation Ser-

vice; "Flood Prevention Methods on the Pacific Slope," C. E. Grunsky, Vice-President, American Society of Civil Engineers; "Standing Waves in Rivers," N. C. Grover, Chief Hydraulic Engineer, United States Geological Survey, Washington, D. C. Ten-minute discussion led by J. B. Challies, Director, Dominion Water Power Branch, Department of the Interior, Ottawa, Ont., Canada; Morris Knowles, Consulting Engineer, Pittsburgh, Pa.; Harrison P. Eddy, Consulting Engineer, Boston, Mass.; George M. Lehman, Engineer, Department of Internal Affairs for Pennsylvania, Harrisburg, Pa.

Evening Session—"Flood Problems of the Miami Valley and Their Solution," Arthur E. Morgan, former Chief Engineer, Miami Conservancy District; Charles H. Paul, Chief Engineer, Miami Conservancy District; discussion.

April 6th—Excursion to Englewood Dam, by special cars, returning in time to reach the plant of the National Cash Register Company at noon. Luncheon and entertainment at the plant of the National Cash Register Company. Excursion to Huffman Dam, leaving the National Cash Register plant by special cars, returning in time to reach Dayton about 5 p. m. Dinner and smoker at the Miami Hotel. Speaker, Colonel E. A. Deeds, "Human Phases of the Miami Conservancy Project."

April 7th—Inspection of Dayton Channel Improvement Work, leaving Engineers' Club by automobiles and arriving at McCook Field at 10 a. m. Inspection of McCook Aviation Field, leaving the field at noon by automobiles for Union Station. Luncheon and excursion to American Rolling Mill plant at Middletown.

NEW ORLEANS ENGINEERS' CLUB

Engineers of New Orleans have organized an Engineers' Club, which holds luncheon-meetings on the third Monday of each month. At the first meeting in February there were 65 members present representing the American Society of Civil Engineers, Louisiana Engineering Society, American Society of Mechanical Engineers, American Chemical Society and the American Association of Engineers. The following officers were elected: President, O. L. Olsen; Vice-President, J. F. Coleman; Secretary, F. A. Muth, and Treasurer, J. F. Villavasso.

INDIANA ENGINEERING SOCIETY

At its forty-third annual meeting in Lafayette last month the Indiana Engineering Society elected the following officers for 1922: President, A. A. Potter, dean, engineering schools, Purdue University; Vice-President, John L. Elliott, city engineer of Indianaoplis.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA

The Engineers' Society of Western Pennsylvania at its recent annual meeting elected the following officers: President, H. D. Jones; Vice-President, Frederick Crabtree, and Directors, J. C. Hobbs and C. D. Terry.

FEDERATION OF ARCHITECTURAL AND ENGINEERING SOCIETIES OF MINNESOTA

On February 21-23 a joint meeting of the Federation of Architectural and Engineering Societies of Minnesota, which is composed of ten organizations, was held at Minneapolis, at which about 350 members were present. The chief sections to meet were the municipal section, drainage section and highway section, at all of which interesting papers were presented. The new officers are: President, John L. Pickles; Vice-President, C. L. Mott; and Secretary-Treasurer, E. G. Briggs.

OHIO ENGINEERING SOCIETY

The following officers were elected by the Ohio Engineering Society at its annual meeting: President, Robert N. Waid; Vice-President, John N. Leach; and Secretary-Treasurer, John W. Graham.

INDIANA SANITARY AND WATER SUPPLY ASSOCIATION

The fifteenth annual meeting of the Indiana Sanitary and Water Supply Association in affiliation with the State Board of Health was held at the Claypool Hotel, Indianapolis, March 22 and 23.

The object of this association is the study of the Sources of Water Supply in the State of Indiana, their Conservation and Purification.

The program included:

Wednesday, March 22, 1922, 10 A. M. —The president's address by Chas. Brossman. Report of secretary-treasurer by C. K. Calvert. The State-wide Fire Prevention Campaign by Newman T. Miller, State Fire Marshal. Spontaneous Combustion by F. C. Atkinson, Chemical Engineer, Indianapolis, and discussion led by F. C. Jordan, chairman Fire Prevention Committee, Indianapolis Chamber of Commerce. "Fire Service as It Relates to Water Supply," Distribution Systems, Care of Fire Hydrants, Location and Care of Gate Valves, Effect of Raising Fire Pressure was the subject of a Round-Table Discussion, led by Dow R. Gwinn, E. L. Loomis and Howard A. Dill. Appointment of committees.

The Luncheon: Address was made by Hon. Warren T. McCray.

Afternoon Session: Construction of a Ten-Million-Gallon Storage Reservoir, by W. C. Mabee. The Dam and Water Impounding Project at Decatur, Illinois, by J. Albert Holmes. Plans for the Development of Indianapolis, by Ed. B. Raub and L. V. Sheridan, City Planning Commission, and Herbert Foltz, Architect, Indianapolis. Service as an Element in Rate-Making, by Carl Wilde, Director of Service, Public Service Commission. Motion Picture—Manufacture of Modern Welded Pipe; courtesy National Tube Co., Pittsburgh, Pa. Lecture by H. G. Breckenridge.

March 23: The Indianapolis Sanitary District—Refuse Collection and Garbage Disposal, by J. A. Craven. Studies on Stream Pollution, by R. E. Tarbett. A Pollution Index of Indiana Streams, by J. C. Diggs. Investigation of Sanitary Conditions of the Calumet River Drainage Area, by L. A. Geupel. Studies of Water Waste at Indianapolis and East Chicago, by George R. Popp, Jr.

Afternoon Session: Round-Table Discussion—"Water Works Building Programs in Indiana," led by J. B. Marvin, B. J. T. Jeup, J. W. Toyne, Charles Streithof, G. G. Blockie, J. O. Endris and Frank L. Dix. Periodic Forecasts of Desirable Water Works Betterments, by Leonard Metcalf. Testing for Iron Removal from Water Supply of Benton Harbor, Mich., by Paul Hansen. Review of East Chicago Filter Operation and Waste Reduction, by E. J. Jenkins.

BROOKLYN ENGINEERS' CLUB

At the March 23d meeting a paper on Compounding the Combustion Engine, illustrated by Lantern slides, was presented by H. J. Scharnagel, chief engineer of the Engine Department of the Sperry Gyroscope Company.

PERSONALS

Graham, Matthew, has been appointed superintendent of the municipal waterworks of Leavenworth, Kans.

Fielder, Joseph A., for four years superintendent of the Steubenville, Ohio, water works, tendered his resignation on January 31st.

Dale, William P., has been appointed township engineer and road superintendent of the township of Stamford, Ont.

Buetow, W. C., has been promoted to the position of bridge engineer of the Wisconsin Highway Commission.

Brumby, James R., Jr., of Mariette, Ga., has been appointed city manager of Ocala, Fla.

Mattis, George, has tendered his resignation as city engineer and superintendent of streets of Oakland, Cal.

Brouk, James A., has been appointed city manager of Pawhuska, Okla.

Thomas, Fred W., has been appointed city engineer of Logan, Utah, to succeed Alma H. Chambers, resigned.

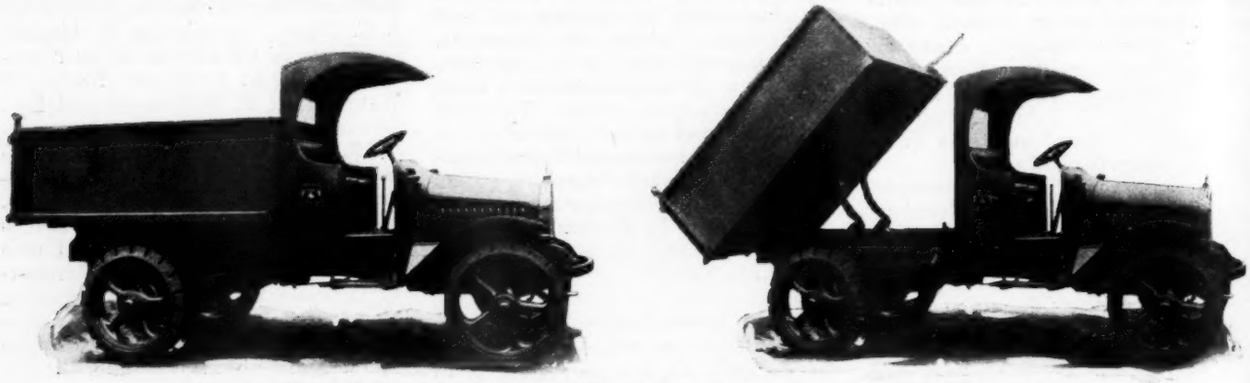
Sillyman, Walter A., of Altoona, Pa., has been elected engineer for the Cambria county commissioners, Ebensburg, Pa.

Wood, Julian P., has been elected superintendent of the water and sewerage department of Marlboro, Mass.

1922

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations



HOUGH MECHANICAL HOIST INSTALLED ON 2-YARD DUMP BODY ON 2-TON CHASSIS.

HOUGH MECHANICAL HOISTS

This appliance, made by the Hough Mechanical Hoist Co., in a 3-ton size, will operate a 2-yard dump body on a 2-ton truck chassis. It is operated with an eccentric drum and segmental pivoted struts and takes the power from the transmission. It can be installed on either side of the truck chassis and has immense lifting power, due to the 4-inch radius of the eccentric drum.

NEW AVERY ROAD ROLLER

The accompanying illustration shows the new Avery Road Roller attached to the Avery 45-65 H. P. Road Tractor.

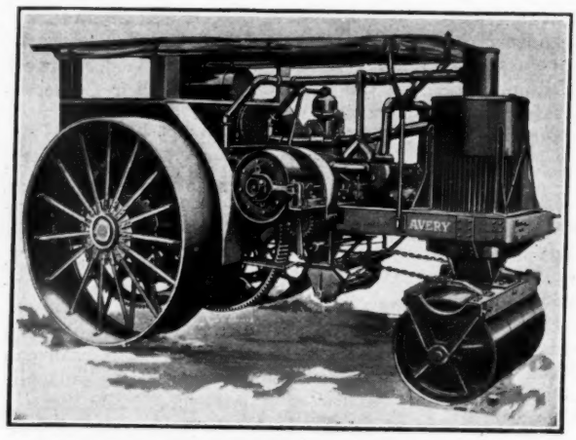
The Avery Road Roller has the same wheel base as the Avery Tractor and sets directly under the front end of the machine in place of the front axle. The tractor will turn around as short with the roller as with the axle. The turntable is mounted on ball bearings. It has about 75 1-inch hardened steel balls that carry the roller and therefore is claimed to turn much easier than the ordinary tractor.

This machine makes it possible for road builders and contractors to roll and pack a road as they grade it.

The idea in furnishing a roller with the tractor is to pack the road as it is built, not leaving the packing to the traffic, which only acts in spots. When a mile of grading is finished with a tractor roller, the sponge qualities of the road have been eliminated and the materials packed harder than by a year of travel.

The tractor with the roller is 9 feet wide and exerts an average pressure of 175 pounds per square inch on the road surface, which means treating every inch of the road six times with a pressure of 175 pounds to the inch, which settles the road, fills up air pockets and spaces that would hold water, makes the road solid and firm next to the ditch, so that the full width of the road is available for traffic instead of a small section.

In building roads with the roller, no more should be opened up than can be finished each day, so that night rains have no more effect on the road than on a road that has had months of travel.



AVERY ROAD ROLLER ATTACHED TO AVERY TRACTOR.

This road roller attachment can easily be removed in less than an hour and wheels can be put on the machine for use in hauling and other jobs that may require a tractor.

A NEW TRAFFIC MARKER

This improved marker is manufactured by the Mound Traffic Equipment Co. for use at street intersections and safety zones. It is constructed to allow automobiles to pass over it without injury to marker, cars, or pedestrians.

The marker is installed on the pavement and stands only 7 inches high above it. The top of the mound shaped marker is one lens designed to throw horizontal beams of light in all directions and secure maximum visibility by night and by day.

It is superior to ordinary tall safety zone signs, because it can, in case of emergency, be run over without injury and because it locates the signal light near the street surface where it is most visible and where the automobile driver's line of sight is directed at a point 100 or 200 feet from the motor, so that it is most readily and probably seen by any driver, and affords him a better opportunity to judge distance than if it were at the same elevation as his eye.

Besides the electric-lighted signal marker the designer has now in process of production a portable day marker for use in places where it is not necessary to maintain night service. This marker is light enough to be easily carried to the sidewalk when not in service and heavy enough to remain in place on the street

THE MOUND TRAFFIC EQUIPMENT COMPANY'S NEW MARKER.

without fastening. The devices are protected by mechanical and process patents and can be produced at low cost, enabling them to be sold at popular prices. Great durability and efficiency are claimed for them.